

control database object in the DBMS performing the transfer and has further disclosed the best mode presently known to the inventors of making and using their system. It will be immediately apparent to those skilled in the relevant technologies that the techniques disclosed herein are not restricted to the particular relational database management system in which they are implemented or indeed to relational database management systems at all, but can be used in any kind of database management system. It will be further apparent that many of the particular techniques used in implementing the system are determined by characteristics of the Oracle 9i database system such as the utilities available for retrieving metadata and moving objects, and that even in the Oracle 9i environment, many other ways of implementing the system are possible. Since that is the case, the *Detailed Description* is to be regarded as being in all respects exemplary and not restrictive, and the breadth of the invention disclosed here in is to be determined not from the *Detailed Description*, but rather from the claims as interpreted with the full breadth permitted by the patent laws.

What is claimed is:

- 1 **1.** Apparatus in a database management system for performing a job which transfers a set of
2 database objects into or out of the database management system, the apparatus comprising:
3 a transfer mechanism that transfers database objects; and
4 a control database object that represents the job,
5 the transfer mechanism operating under control of the control database object to transfer the
6 objects in the set.
- 1 **2.** The apparatus set forth in claim 1 wherein:
2 the control database object specifies the set of objects.
- 1 **3.** The apparatus set forth in claim 2 wherein:
2 the control database object further specifies an order in which the transfer mechanism
3 transfers the objects in the set.
- 1 **4.** The apparatus set forth in claim 2 wherein:
2 the order orders the objects in the set by size.
- 1 **5.** The apparatus set forth in claim 2 wherein:
2 the control database object includes a filter that further specifies the set of objects.
- 1 **6.** The apparatus set forth in claim 1 wherein:
2 the transfer mechanism further performs an operation on one or more objects belonging
3 to the set; and
4 the control database object includes a specification of the operation.
- 1 **7.** The apparatus set forth in claim 6 wherein:
2 the operation is an operation that transforms the object.
- 1 **8.** The apparatus set forth in claim 7 wherein:
2 the operation is an operation that remaps a name in the object to a different name.
- 1 **7.** The apparatus set forth in claim 1 wherein:

2 the control database object includes a specification of one or more parameters for the
3 job,
4 the transfer mechanism transferring the objects in the set as specified by the parameter.

1 **8.** The apparatus set forth in claim 7 wherein:

2 the parameter is an estimate only parameter,
3 the transfer mechanism responding thereto by providing an estimate of the space required for
4 the objects in the set without transferring the objects.

1 **9.** The apparatus set forth in claim 1 wherein:

2 the control database object includes a specification of a status of the job; and
3 the transfer mechanism updates the status in the specification during the transfer.

1 **10.** The apparatus set forth in claim 9 wherein:

2 the control database object is queryable to obtain a current status of the job from the
3 specification of the status.

1 **11.** The apparatus set forth in claim 9 wherein:

2 the transfer mechanism employs the specification of the status of the job to restart the
3 job after the job has been stopped.

1 **12.** The apparatus set forth in claim 1 wherein:

2 the control database object specifies a remote database management system as a source
3 of the set of objects; and

4 the transfer mechanism fetches the set of objects from the remote database management
5 system.

1 **13.** The apparatus set forth in claim 12 wherein:

2 the control database object specifies the database management system as a destination
3 of the set of database objects; and

4 the transfer mechanism further fetches the set of database objects into the database
5 management system.

1 **14.** The apparatus set forth in claim 1 wherein:
2 the control database object specifies a set of files in the database system as a source or
3 destination of the set of database objects.

1 **15.** The apparatus set forth in claim 14 wherein:
2 when the set of files is the source of the set of database objects, the set of files is the
3 result of a job and includes a copy of the control database object for the job.

1 **16.** The apparatus set forth in claim 14 wherein:
2 the control database object is a table and includes rows representing objects belonging
3 to the set of objects.

1 **17.** The apparatus set forth in claim 16 wherein:
2 each row representing an object belonging to the set includes a specification of an order
3 in which the object represented by the row was transferred to the set of files relative to other
4 objects belonging to the set.

1 **18.** The apparatus set forth in claim 16 wherein:
2 when the set of files is the destination of the set of database objects, there is a row
3 representing each object that has been transferred to the set of files.

1 **19.** The apparatus set forth in claim 16 wherein:
2 when the set of files is the source of the set of database objects, there is a row
3 representing each object which is to be transferred into the database management system.

1 **20.** The apparatus set forth in claim 19 wherein:
2 the row representing a particular object includes a field whose value specifies an order in
3 which the object is to be transferred relative to the other objects.

1 **21.** The apparatus set forth in claim 16 wherein:
2 the set of files is the result of a job and includes a copy of the control database object
3 for the job, the copy having a row for each database object contained in the set of files; and

4 when the transfer mechanism is transferring the objects belonging to the set of objects
5 from the set of files into the database management system, the control database object contains
6 a copy of at least the rows representing the objects from the copy of the control database object
7 in the file set.

1 **22.** The apparatus set forth in claim 16 wherein:

2 the row in the copied rows representing a particular object includes a field whose value
3 specifies an order in which the object is to be transferred relative to the other objects represented
4 by the copied rows.

1 **23.** The apparatus set forth in claim 14 wherein:

2 the control database object further specifies a template whereby the transfer mechanism
3 may add a file to the set of files when required for transferring the objects.

1 **24.** The apparatus set forth in claim 1 wherein:

2 the control database object specifies a remote database management system as a source
3 of the set of objects and a set of files in the database system as a destination therefor; and
4 the transfer mechanism transfers the set of objects from the remote database
5 management system to the set of files.

1 **25.** The apparatus set forth in claim 1 wherein:

2 the control database object specifies a set of files in the database system as a source of
3 the set of objects; and
4 the transfer mechanism transfers the set of objects from the set of files into the database
5 management system

1 **26.** The apparatus set forth in claim 1 wherein:

2 the transfer mechanism further provides an interface whereby an entity that uses the
3 transfer mechanism may interact with the job.

1 **27.** The apparatus set forth in claim 26 wherein:

2 the interface permits the entity to attach to and detach from the job for as long as the
3 job's control database object exists, transfer of the objects by the transfer mechanism being
4 unaffected by detachment of the user from the job.

1 **28.** The apparatus set forth in claim 26 wherein:

2 the entity may use the interface via a network connection to the database management
3 system.

1 **29.** The apparatus set forth in claim 26 wherein:

2 the interface includes a defining interface whereby the entity may define a portion of
3 the job's control database object.

1 **30.** The apparatus set forth in claim 26 wherein:

the interface includes an executing interface whereby the entity may interact with the transfer mechanism from the time the transfer mechanism begins transferring the objects in the set until the job's control database object ceases to exist.

1 **31.** The apparatus set forth in claim 30 wherein:

2 the entity may use the executing interface to obtain a current status of the job from a
3 specification of the status of the job in the control database object.

1 **32.** The apparatus set forth in claim 27 wherein:

2 the entity may use the executing interface to stop performance of the job by the transfer
3 mechanism or the transfer mechanism may stop performance of the job in response to an error.

1 **33.** The apparatus set forth in claim 32 wherein:

the entity may use the executing interface to restart a stopped job, the transfer mechanism using a specification of the status of the job in the control database object to restart the job.

1 **34.** The apparatus set forth in claim 30 wherein:

2 the entity may use the executing interface to affect allocation of resources by the
3 transfer mechanism to the job.

1 **35.** The apparatus set forth in claim 34 wherein:

2 the transfer mechanism operates on objects in the set in parallel; and
3 the entity uses the executing interface to specify a maximum degree of parallelism for
4 the job.

1 **36.** A set of files for transferring a set of database objects into a database management system,
2 the set of files comprising:

3 at least one file containing the objects belonging to the set thereof; and
4 a control object in the set thereof that specifies for each object belonging to the set the
5 location of the object in the set of files and an order in which the database management system
6 transfers object during the transfer.

1 **37.** The set of files set forth in claim 36 wherein:

2 the file further includes metadata that defines a type of database objects and one or
3 more database objects that belong to the type defined by the metadata; and
4 the order determines that the metadata is processed before the database objects that
5 belong to the type defined by the metadata.

1 **38.** The set of files set forth in claim 36 further comprising:

2 a header in each file of the set, the header including
3 an indication the control object is contained in the file and if so, the location of
4 the control object in the file and
5 an identifier that identifies the file within the set; and
6 the control object uses the identifier in specifying the location of the object in the set of
7 files.

1 **39.** A method of transferring database objects to a destination, each database object having
2 metadata that defines the database object's type and
3 the method comprising the steps of:

4 obtaining metadata for the object type using the metadata to make a determination of
5 the composition of the objects of the type;
6 selecting a transfer technique for objects belonging to the type from a plurality thereof
7 according to the determination; and
8 transferring the objects belonging to the type according to the selected transfer
9 technique.

1 **40.** The method of transferring database objects set forth in claim 39 wherein:

2 in the step of transferring, the objects are transferred in parallel.

1 **41.** The method of transferring database objects set forth in claim 40 further comprising the
2 step of:

3 receiving a value that specifies a degree of parallelism,
4 the objects being transferred in parallel as determined by the degree of parallelism.

1 **42.** The method of transferring database objects set forth in claim 40 wherein:

2 the transfer technique for certain of the objects permits transfer of portions of the
3 contents of the object in parallel; and

4 in the step of transferring the certain objects, the portions are transferred in parallel.
5

1 **43.** A method of performing a job that transfers a set of database objects into or out of a
2 database management system that includes a transfer mechanism that transfers the database
3 objects under control of a control database object in the database management system that
4 represents the job,

5 the method comprising the steps of:

6 defining the job's control database object; and

7 executing the job by causing the transfer mechanism to transfer the set of database
8 objects under control of the job's control data base object.

1 **44.** The method of performing a job set forth in claim 43 further comprising the step
2 performed in either the defining step or the executing step of:

3 attaching to the job, attachment permitting at least reading and/or modification of the
4 job's control database object.

1 **45.** The method of performing a job set forth in claim 44 further comprising the step
2 performed after the step of attaching to the job of:

3 reading the job's control database object to get the job's current status.

1 **46.** The method of performing a job set forth in claim 44 wherein
2 the transfer mechanism transfers the data objects in parallel and
3 the method further comprises the step performed after the step of attaching to the job of:
4 specifying a degree of parallelism with which the objects may be transferred.

1 **47.** The method of performing a job set forth in claim 44 wherein the method further
2 comprises the step performed after the step of attaching to the job of:
3 starting the step of executing the job.

1 **48.** The method of performing a job set forth in claim 44 wherein the method further
2 comprises the step performed after attaching to the job of:
3 stopping the step of executing the job.

1 **49.** The method of performing a job set forth in claim 48 wherein the step of stopping the step
2 of executing the job further comprises the step of:
3 saving job state in the control database object such that the step of executing the job
4 may be restarted from the job state.

1 **50.** The method of performing a job set forth in claim 43 wherein:
2 the step of defining the job includes the step of creating the job's control database
3 object.

1 **51.** The method of performing a job set forth in claim 43 wherein:
2 the step of defining the job includes the step of specifying a source and/or destination
3 for the set of database objects in the job's control database object.

1 **52.** The method of performing a job set forth in claim 43 wherein:
2 the step of defining the job includes the step of specifying the set of database objects in
3 the job's control database object.

1 **53.** The method of performing a job set forth in claim 52 wherein:
2 the step of defining the job includes the step of specifying a filter in the job's control
3 database object, the filter defining a subset of the specified set of database objects as the set of
4 objects to be transferred in the job

1 **54.** The method of performing a job set forth in claim 43 wherein:
2 the step of defining the job includes the step of specifying an operation in the job's
3 control database object that is to be performed on one or more objects in the set.

1 **55.** The method of performing a job set forth in claim 43 wherein:
2 the step of defining the job includes the step of defining a parameter for the job in the
3 job's control database object for the job.

1 **56.** The method of performing a job set forth in claim 43 wherein
2 the step of executing the job includes the step performed when the step of executing the
3 job must be stopped of:
4 saving job state in the control database object such that the stopped executing step may
5 be restarted from the job state

1 **57.** The method of performing a job set forth in claim 56 wherein the step of executing the job
2 includes the step performed when the step of executing the job has been stopped of:
3 using the job state to restart the stopped executing step.